

NON-PUBLIC?: N  
ACCESSION #: 9405020227  
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Edwin I. Hatch Nuclear Plant - Unit 1 PAGE: 1 OF 5

DOCKET NUMBER: 05000321

TITLE: Arcing in Main Generator Exciter Results in Automatic  
Reactor Shutdown  
EVENT DATE: 03/29/94 LER #: 94-003-00 REPORT DATE: 04/25/94

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR  
SECTION:  
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:  
NAME: Steven B. Tipps, Nuclear Safety and TELEPHONE: (912) 367-7851  
Compliance Manager

COMPONENT FAILURE DESCRIPTION:  
CAUSE: X SYSTEM: TL COMPONENT: MANUFACTURER: U035  
REPORTABLE NPRDS: Yes

SUPPLEMENTAL REPORT EXPECTED: No

#### ABSTRACT:

On 3/29/94 at 0101 EST, Unit 1 was in the Run mode at a power level of 2436 CMWT (100 percent rated thermal power). At that time a full Reactor Protection System (RPS) actuation and an automatic reactor shutdown occurred due to a trip of the Main Turbine. When the Main Turbine tripped, reactor pressure increased as expected to a maximum of 1085 psig and was relieved by the automatic opening of the Main Turbine Bypass Valves and seven safety relief valves (SRVs) per design. The SRVs closed as required and reactor pressure was then controlled by the Main Turbine Bypass Valves. Reactor water level decreased to a minimum of 14 inches above instrument zero (172 inches above the top of active fuel), resulting in closure of the inboard Group 2 Primary Containment Isolation System valves. Normal reactor water level was restored with the Feedwater System. The cause of this event was a loss of Main Generator field excitation leading to a trip of the Main Turbine and an automatic

reactor shutdown. Field excitation was lost when arcing occurred between the Main Generator Exciter (MGE) brush rigging and one of the collector rings on the MGE rotor. Engineering personnel believe the primary factor in the arcing was sticking of a brush in the brush rigging.

Corrective actions for this event included replacing the damaged MGE rotor with a rotor from the Unit 2 MGE, sending the Unit 1 MGE rotor off site for repair, and increasing the frequency of MGE brush inspections to daily.

END OF ABSTRACT

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## PLANT AND SYSTEM IDENTIFICATION

General Electric - Boiling Water Reactor

Energy Industry Identification System codes appear in the text as (EIIIS Code XX).

## DESCRIPTION OF EVENT

On 3/29/94 at 0101 EST, Unit 1 was in the Run mode at a power level of 2436 CMWT (100 percent rated thermal power). At that time Unit 1 experienced a full Reactor Protection System (RPS, EIIIS Code JC) actuation and an automatic reactor shutdown following a trip of the Main Turbine (EIIIS Code TA) on a Main Generator (EIIIS Code TB) sensed loss of field excitation. When the Main Turbine tripped, reactor pressure increased as expected resulting in the Main Turbine Bypass Valves automatically opening, seven of the eleven Safety Relief Valves (SRVs) opening, and Low-Low Set (LLS, EIIIS Code JE) actuating. The SRVs closed as required after relieving the initial pressure transient and reactor pressure was controlled thereafter by the Electrohydraulic Control (EHC, EIIIS Code TG) system and the Main Turbine Bypass Valves. Reactor pressure reached a maximum during the transient of 1085 psig. Following the reactor shutdown, reactor water level decreased as expected due to steam void collapse resulting from the pressure increase and the rapid power reduction produced by control rod (EIIIS Code AA) insertion and trip of the Reactor Recirculation (EIIIS Code AD) System pumps. Water level was recovered by use of the Reactor Feedwater Pumps (RFPs, EIIIS Code SK). The minimum water level reached was 14 inches above instrument zero (172 inches above the top of active fuel) which is very close to the setpoint of the Level 3 instrumentation for the Group 2 Primary Containment Isolation System (PCIS, EIIIS Code JM) valves. Thus the inboard PCIS valves received a closure signal and responded as required. The outboard Group 2 PCIS valves did not close because not all their isolation logic

was tripped during the event. Nominal variations in sensed level arising from calibration tolerances account for the fact that not all the Level 3 instruments for inboard and outboard PCIS valves actuated simultaneously.

When the transient occurred, licensed shift personnel confirmed all expected actuations occurred as designed per procedure 34AB-C71-001-IS, "SCRAM PROCEDURE." At 0114 EST the 'A' loop of the Reactor Recirculation System was restarted to prevent thermal stratification of the reactor coolant, and at 0121 EST the 'B' loop was started also. Following other necessary actions to ensure plant conditions had stabilized, shift personnel entered procedure 34GO-OPS-013-1S, "NORMAL PLANT SHUTDOWN" at 0150 EST and continued placing plant systems in lineups appropriate for the Hot Shutdown condition.

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## CAUSE OF EVENT

The cause of this event was a loss of Main Generator field excitation leading to a trip of the Main Turbine and an automatic reactor shutdown. Main Generator field excitation was lost when arcing occurred between the exciter brush rigging and one of the collector rings on the rotor shaft of the Main Generator Exciter (MGE, EIIS Code TL). Engineering personnel who investigated the event believe the primary reason for the arcing was a carbon brush sticking in its rigging. Normally, brushes must be free to move to maintain electrical contact while accommodating motion due to normal machine vibration, slight collector ring eccentricity, and brush wear. It is believed that when the brush became lodged in its rigging, an air gap developed between the brush and the collector ring, leading to a small amount of initial arcing. This arcing roughened the surface of the collector ring which damaged all the other brush contact surfaces on the involved ring and led to a phenomenon of much more intense arcing known as "flashover." When flashover occurred in the MGE, excitation was lost which actuated the Main Generator loss of excitation relay, resulting in a Main Turbine trip and a full RPS actuation.

## REPORTABILITY ANALYSIS AND SAFETY ASSESSMENT

This event is reportable per 10 CFR 50.73 (a)(2)(iv) because unplanned actuations of engineered safety features (ESFs) occurred, including an unplanned automatic reactor shutdown following a trip of the Main Turbine on a loss of Main Generator field excitation.

Loss of field excitation in the Main Generator is sensed by a device which signals the Main Turbine to trip and the Main Generator Power Circuit Breakers (EIIS Code EL) to open. The Main Turbine stop valves

and control valves close rapidly to prevent overspeed of the Main Turbine-Generator. Rapid closure of these valves causes a sudden reduction in steam flow which results in the nuclear system pressure increasing and the Main Turbine Bypass Valves fully opening. To limit the transient on the nuclear system, the Main Turbine trip signal is an input to the Reactor Protection System which initiates an automatic reactor shutdown. Rapid power reduction is further ensured by an automatic trip of the Reactor Recirculation System pump motor breakers whenever a Main Turbine trip occurs at reactor power levels of 30 percent or greater. The Final Safety Analysis Report (FSAR) assumes that an event involving a Main Turbine trip at rated power will result in nuclear system pressures sufficient to lift some or all of the SRVs. Following an initial relief of steam through the SRVs to the suppression pool, reactor pressure is controlled by discharging steam through the Main Turbine Bypass Valves to the Main Condenser (EIS Code SG).

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In this event, all plant systems responded as designed to a Main Generator loss of excitation, including the RPS, the Recirculation System Pump trip (or, RPT), the SRVs and LLS logic, the EHC System, and the Bypass Valves. The closure of some Group 2 PCIS valves is explained by the reactor water level transient in which water level decreased to the point where some, but not all, Level 3 instrumentation tripped. The High Pressure Coolant Injection (HPCI, EIS Code BJ) system did not inject to the vessel during this event, nor was it required to since reactor water level remained well above the Level 2 initiation setpoint at all times during the transient. Water level was controlled by the RFPs and normal Feedwater Level Control. There were no unusual, unexpected, or unexplained occurrences associated with this transient. The minimum reactor water level observed during the event was 172 inches above the top of active fuel, and the maximum reactor pressure was 1085 psig. Both of these are well within the limits of current safety analyses. Had a design basis accident occurred coincident with this event, all systems assumed by current accident analyses to function would have responded per design.

Based on this analysis, it is concluded that this event had no adverse impact on nuclear safety. This analysis is applicable to all power levels.

## CORRECTIVE ACTIONS

1. The MGE rotor from Unit 2, which is currently in a refueling outage, was installed in Unit 1, and Unit 1 was returned to full power operation.

2. The rotor from the involved Unit 1 exciter has been sent off site for repair.

3. The frequency of brush inspections has been changed from monthly to daily on both units' Main Generator Exciters.

#### ADDITIONAL INFORMATION

1. Other Systems Affected: No systems were affected by this event other than those already mentioned in this report.

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#### 2. Failed Equipment Information:

Master Parts List Number: 1N51-S001 EIIS System Code: TL  
Type: Carbon Brush EIIS Component Code: None  
Manufacturer: Union Carbide Root Cause Code: X  
Model Number: 634 Reportable to NPRDS: Yes  
Manufacturer Code: U035

3. Previous Similar Events: No events have been reported in the past two years in which automatic reactor shutdowns resulted from failures in the Main Generator or switchyard.

ATTACHMENT TO 9405020227 PAGE 1 OF 1

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J. T. Beckham, Jr. Georgia Power  
Vice President - Nuclear the southern electric system  
Hatch Project April 25, 1994

Docket No. 50-321 HL-4572

U.S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Washington, D.C. 20555

Edwin I. Hatch Nuclear Plant - Unit 1  
Licensee Event Report

Arcing in Main Generator Exciter Results  
in Automatic Reactor Shutdown

Gentlemen:

In accordance with the requirements of 10CFR50.73 (a)(2)(iv), Georgia Power Company is submitting the enclosed Licensee Event Report concerning arcing in the main generator exciter which resulted in an automatic reactor shutdown. This event occurred at Plant Hatch - Unit 1.

Sincerely,

J. T. Beckham, Jr.

JKB/cr

Enclosure: LER 1-94-003

cc: Georgia Power Company  
Mr. L. H. Sumner, General Manager - Nuclear Plant  
NORMS

U. S. Nuclear Regulatory Commission, Washington, D. C.  
Mr. K. Jabbour, Licensing Project Manager - Hatch

U. S. Nuclear Regulatory Commission, Region II  
Mr. S. D. Ebnetter, Regional Administrator  
Mr. L. D. Wert, Senior Resident Inspector - Hatch

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